AN ECOLOGICAL STUDY OF THE FLORA OF MOUNT WILSON.

Part ii. The Eucalyptus Forests.

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(Plates xx-xxii; and four Text-figures.)

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Contents.

Introduction.

In the first of these Memoirs on the plant-covering of Mount Wilson, a study was made of the vegetation of the basalt soil, which comprises the Malayan Rain-Forest and certain communities on the outskirts dominated by the endemic *Eucalyptus*. In this second Part it is proposed to give a brief account of some of the salient features of the Eucalyptus Forests, which constitute the vegetation of the sandstone plateau, supplementing also the previous observations on the Eucalyptus communities of the basalt. A third publication will deal with the plant communities of the valleys and their distribution, correlating them with those of the plateau.

Eucalyptus Forest, the unique Endemic Flora of this Continent, is perhaps one of the most extensive plant formations in the world, and its ecology is practically an unopened book: little more has, therefore, been attempted in the present paper than to outline the main communities in the small area under consideration; to record some observations on their distribution and inter-relationships; and to hint at a few of the many important problems connected with their adaptations, development, and such other features as are urgently awaiting intensive study.

I have to record my indebtedness to Assistant-Professor McLuckie for his help in the field and advice in the preparation of the paper; to Professor Lawson for the interest he has always shown in the Mount Wilson work, and for suggestions on a number of occasions; to Mr. M. B. Welch, B.Sc., A.I.C., for kind permission to reproduce one of his photographs of Mount Wilson; and to Mr. O. D. Evans for his generous assistance in the identification of a number of the types referred to in this paper.

General Physiognomy of Eucalyptus Forest.

Eucalyptus Forest, the chief expression of the Australian endemic flora, as has been said, is perhaps one of the most extensive plant formations in the world, and occupies the greater part of Australia.

It was stated in Part I that the Australian flora possessed a number of outstanding peculiarities; and, indeed, many of the features of the Eucalyptus Forests are unique. With a few exceptions, the association dominants are species of *Eucalyptus*, and the fact, that there are about three hundred species in Australia, gives some idea of the peculiar complexity of the formation; despite this, however, the physiognomy is characteristically uniform, the components, almost entirely xerophytes, being typically sclerophyllous in life-form. All the species of *Eucalyptus* possess the same xerophytic facies imparted by their gnarled and spreading boughs, and broad crown of drooping isobilateral leaves. The foliage is small in amount for the size of the trees, being chiefly distal, a xerophytic adaptation which is not least among the distinctive physiognomic features of these trees. The bark is also characteristic, being either stringy, rough, often fissured, and dark grey in colour; or else smooth, pale bluish-grey in colour, containing chlorophyll in the phelloderm, and being cast annually. The accompanying plates (Pl. xx-xxii) help to bring out a number of these features.

The trees are seldom close enough for their crowns to meet, and in any case the open nature of their foliage results in little obstruction to the penetration of light to the ground; there is thus considerable scope for the development of shrubs, which are a characteristic feature of most Eucalyptus Forests, and are extremely numerous in species and life-form (see Text-fig. 1), although the majority are markedly xerophytic, sclerophyllous and often coriaceous. The ground between the shrubs is occupied by smaller shrubby plants, grasses and annuals, also highly xerophytic.

Thus, on the whole, Eucalyptus Forest is a very xerophilous type of vegetation; but some associations, adapted to damp or sheltered habitats, as has been seen on the basalt at Mount Wilson, contain more mesophytic types, although it is noteworthy that many of the latter are Malayan rather than endemic in origin.

The contrast between Eucalyptus Forest and the Rain-Forest at Mount Wilson is profound: the former is lowly integrated and a characteristic expression of xerophily; the latter has the high integration characteristic of luxuriant vegetation and is typically mesophilous. This feature of integration is clearly shown by the result of the cutting out of the dominants in the two communities: in the Eucalyptus Forest no great change as a rule ensues, except that the shrubs form a closer community; in the Rain-Forest, on the contrary, there is little doubt but that the majority of the subordinates, which are present only as a result of the powerful reaction of the dominants upon the rest of the community, would disappear entirely; even in the Eucalyptus-Doryphora association great changes have taken place. Thus it is that the interdependence characteristic of the Rain-Forest is distinctly lacking in Eucalyptus Forest: epiphytes are scarce; ombrophytes are absent. Another feature of contrast, so far as Mount Wilson is concerned, is the great floristic richness which often characterises Eucalyptus Forests and increases the possibility of variation; while the Rain-Forest is comparatively poor in number of species at Mount Wilson on account of the severity of the climate.

CLASSIFICATION OF COMMUNITIES.

With those who are carrying out the pioneering investigations in synecology in Australia, lies the responsibility of co-ordinating upon a scientific basis of classification the communities which they are studying; and the fact, that little has so far been done in this direction, added to the great complexity of Eucalyptus Forests, is such as to render their ecological classification a task often beset with difficulty. In this study the concepts of the British workers have been followed as closely as possible, these being based largely on Clements's scheme (Clements, 1916) with the adoption, however, of Tansley's conception of climax communities (Tansley, 1920) The Eucalyptus Forests have been divided into associations, regarding all communities resembling one another in floristic composition as belonging to one association, these being divided into consociations according to the distribution of the dominants. In certain cases the number of consociations in an association will probably be found to be extraordinarily large when all the Eucalyptus Forests have been surveyed, an inevitable consequence with lowly integrated communities and with a genus so versatile as *Eucalyptus*. This is a feature which leads to a certain difficulty in nomenclature: for instance, what is assuredly one association, having consociations of *Eucalyptus piperita* and *E. haemastoma* var. *micrantha* at Mount Wilson, is dominated in other localities on the Blue Mountains by *E. Sieberiana* and other species, while in the Sydney districts consociations of *E. haemastoma* and *E. pilularis* have been observed. In designating such an association, as Clements has pointed out, only two names can be used; yet it is desirable that the two selected should be the dominants most widely distributed and most characteristic of the association. As this information has not yet been obtained in the case in question, the association has been named for the present from the two dominants occurring at Mount Wilson. It must be understood, however, that this term will possibly require alteration later on; indeed, the whole concept of the status of the communities of the Eucalyptus Forests and their nomenclature, given in this paper, must be regarded as more or less tentative, being only a first attempt based upon observations made over a small area.

The low integration of Eucalyptus Forests is likely to be responsible for many problems connected with the definition of status. It is no uncommon occurrence for one society of shrubs to occur in two different associations; and the typical shrub-stratum of a Eucalyptus association may occur where the development of trees is inhibited, with the result that the shrub-community changes from the rank of a stratum-society to that of a definite association. Examples of these phenomena will be discussed in the subsequent pages.

Having divided the Eucalyptus Forest into associations, it is desirable to have a name for Eucalyptus Forest as a whole, and for this the term "formation" seems to suggest itself. Unfortunately this word has had a somewhat chequered career, being used in different senses by different workers: yet this reversion to its use in the sense indicated by Warming (1909) seems perhaps more useful in the present instance than the most recent definition of Tansley (1920); this, however, only time and the work of subsequent investigators of Australian ecology will show.

THE ASSOCIATIONS.

Following upon the method of classification adopted above, two associations have been recognised for the present in the Eucalyptus Forest at Mount Wilson.

They are:

(1) An association dominated by *Eucalyptus goniocalyx*, *E. Blaxlandi* and *E. viminalis*, which will be termed for convenience the *Eucalyptus goniocalyx-E. Blaxlandi* association. This includes what was previously called the *Eucalyptus-Alsophila* association and part of the *Eucalyptus-Pteridium* association.

(2) The *Eucalyptus piperita-E. haemastoma* var. *micrantha* association, which clothes the greater part of the sandstone plateau and the dry slopes.

In addition to these is the Eucalyptus-Doryphora association, which is perhaps better regarded as an ecotone.

The Eucalyptus-Doryphora Ecotone.

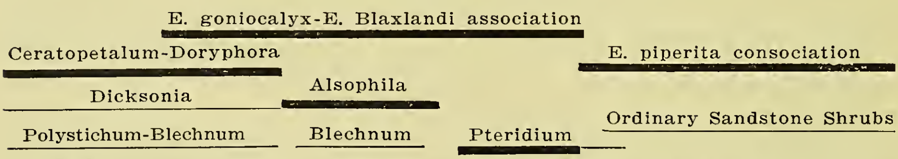
This community has been described already in Part I (p. 485), and represents the ecotone between the *Ceratopetalum-Doryphora* and the *Eucalyptus goniocalyx-E. Blaxlandi* associations. In such places as it forms a thin, fragmentary fringe at the edge of the *Ceratopetalum-Doryphora* association, *Eucalyptus goniocalyx* and *E. Blaxlandi* are co-dominants, while *E. viminalis* is occasionally present; the optimum expression of the association, however, is found on the lower slopes of the mountain, on the first basalt residual reached by the road from Bell (see Map, Part I, Plate lvii). Here *Eucalyptus viminalis* occurs as a dominant in certain areas, while *Eucalyptus oreades* is locally dominant, forming societies in which the other species are only occasional.

The Eucalyptus goniocalyx-E. Blaxlandi Association.

Nomenclature.

What were termed the *Eucalyptus-Alsophila* and *Eucalyptus-Pteridium* associations have been described at some length in Part I. The system of nomenclature adopted therein for these communities, however, was purely a tentative one; for, at the time of writing, the observations on the distribution of the Eucalyptus trees were not verified, and therefore were not adopted as a basis of classification. Meanwhile, a special study has been made of the distribution of *Eucalyptus* at Mount Wilson, and it is now possible to place the nomenclature of these communities upon a more logical foundation.

The co-ordination of the communities of the Junction Flora, however, is found to be by no means simple, as is indicated by the following diagrammatic representation of the manner in which they overlap in the various strata:



It is here seen that the *Alsophila* zone does not delimit an association, since the dominant trees extend into the *Pteridium* zone; and also the *Pteridium* zone extends into the *E. piperita* Forest, an example of the low integration of Eucalyptus communities. These facts have led to the establishment of the following system of nomenclature:

Ceratopetalum-Doryphora association
Eucalyptus-Doryphora ecotone

E. goniocalyx-E. Blaxlandi association { *Alsophila* stratum-society; *Pteridium* stratum-society }

E. piperita consociation of the *E. piperita-E. haemastoma* var. *micrantha* association { *Pteridium* stratum-society; Typical sandstones shrub stratum-society }

Distribution and Structure.

The *Alsophila* and *Pteridium* stratum-societies have been discussed to some extent in Part I; it remains, however, in this and a subsequent Part, to record some observations on the distribution of the components of the tree-stratum.

Eucalyptus goniocalyx, *E. Blaxlandi* and *E. viminalis* are seldom if ever co-dominant in one place, more usually forming consociations in which the others are only subordinate; *E. oreades* occurs also as a locally frequent type in this association.

The *E. viminalis* consociation, with *E. Blaxlandi* abundant, was observed only in one place (see Plate xxi, fig. 5), on a southern basalt slope near the road immediately east of the Section line (see map, Part I, Plate lvii); elsewhere the *E. goniocalyx* consociation, with *E. Blaxlandi* (f-a), *E. viminalis* (lo) and *E. oreades* (lf), is more usually found (Plate xx, fig. 1). The *E. Blaxlandi* consociation, with *E. goniocalyx* (o), occurs on the summit of basalt hills which are fully exposed to the west (*e.g.* summit of hill on left of Text-fig. 3, Part I, p. 489); here the *Pteridium* society usually replaces *Alsophila*. Further reference will be made to the distribution of these consociations in Part III.

The tree-fern barrier, and the junction between the *Blechnum* and *Pteridium* societies, are correlated with no difference in the structure and composition of the tree-stratum. At the periphery of the basalt caps the volcanic-soil stratum grows very thin, and finally disappears. It may be supposed that the shallow-rooting Alsophilas cease when the basalt soil is no longer deep enough for them to root in. The *Eucalyptus* trees, however, are not restricted to the basalt in this way, and, indeed, for some distance on to the periphery of the basalt they probably send their roots partly into the underlying sandstone: they appear to be controlled in their distribution by high moisture requirements, which are satisfied not only on the basalt but also on the adjacent sandstone. Thus in one locality the same consociation spreads over the *Alsophila* and *Pteridium* societies up to the junction with the *Eucalyptus piperita* Forest.

The association is plainly suited to a moister or richer soil than the typical dry-sandstone Eucalyptus Forests, being confined to the basalt and the adjacent sandstone which is probably enriched by leaching and percolation from the former, and also to the damp soil of the valleys.

The dominant trees are of great stature, averaging 150 to 200 feet in height, and with a spread often 40 feet in diameter; but they are never near enough to one another to form a closed canopy, a point well illustrated in Part I, Text-fig. 4 (p. 488).

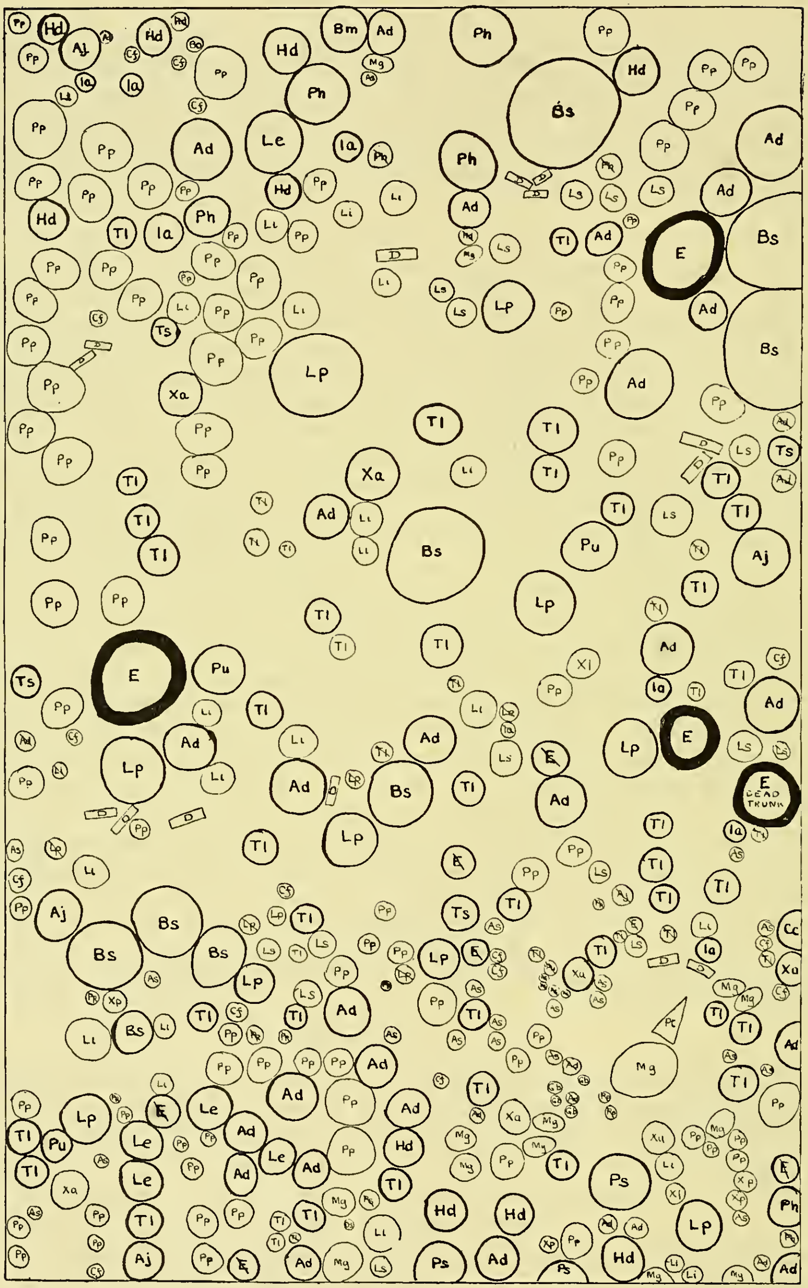
The Stratum-Societies.

Some additional observations have to be recorded upon certain of the stratum-societies of the Junction Flora, but for various reasons it is felt advisable to withhold these until after the discussion of the *Eucalyptus piperita* Forest.

THE EUCALYPTUS PIPERITA-E. HAEMASTOMA VAR. MICRANTHA ASSOCIATION.

STRUCTURE AND PHYSIOGNOMY.

This association is the main expression of Eucalyptus Forest as it occurs on the Hawkesbury Sandstone in New South Wales, and possesses the characteristic structure and physiognomy to which reference has already been made. Although the total number of dominants of the whole association is large, at Mount Wilson there are only two, namely *Eucalyptus piperita* and *E. haemastoma* var. *micrantha*



Text-fig. 1.—Chart of a portion of the *Eucalyptus piperita* consociation, showing the complex composition of the shrub strata. The tall shrubs are indicated with heavy outlines. The structure of the lower strata is seen to be slightly more open beneath the canopy of the trees. (Scale, 1 in. = 6 ft.)

These trees occur in consociations, and attain a height of from fifty to one hundred feet according to the degree of exposure and soil-moisture. *Eucalyptus Sieberiana* and *E. eugenioides* are subordinates.

The shrub-stratum has a more or less open structure and ranges from four to six feet in height (see Plate xxi, fig. 3), although an occasional individual attains the stature of a small tree. The low-shrub stratum is also of open structure, reference to the chart (Text-fig. 1) indicating how much of the ground is bare; it may be supposed, however, that the habitat is covered to the limit of the comparatively meagre supply of water and nutrient materials.

The shrubs are all of the evergreen sclerophyllous type, but otherwise they tend to show unlike reactions to the environmental conditions, although many species belonging to different genera and even different families may have reacted along the same lines and hence may bear close similarities.

There is a general tendency towards reduction in size, the most characteristic feature of xerophily. This is expressed particularly in the chlorophyll-bearing organs, but that the vegetation in question is not an extremely arid type is clearly evinced by the fact that, although the leaves are generally small, in only a few of the species are they minute or even acicular; and, while the majority of the species of *Acacia* bear phyllodes, *A. discolor* has pinnate leaves and yet finds a favourable habitat in this association. Quite another line of reaction is shown in a small number of types with comparatively large leaves, such as *Banksia serrata* and *Persoonia salicina*, which have broad leaves up to six inches in length; in the majority of such types, however, the leaves are isobilateral, as in the case of *Persoonia*.

The structural adaptations of these sandstone xerophytes have not yet been submitted to detailed study, but it is hoped that such an inquiry will form the subject of a later publication.

THE RELATION TO FIRES.

Bush-fires are a fundamental factor controlling the development of Eucalyptus Forests in New South Wales, since their occurrence throughout the summer is so frequent; and the greater part of the Eucalyptus Forest of the Mount Wilson plateau has at some period been burnt, to which charred wood and blackened tree-trunks bear abundant evidence.

These fires pass through the Forest with considerable ease and rapidity, a fact made possible by the low water-content of the plants and the inflammable essential oils present in the leaves of the myrtaceous and rutaceous types. As a

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KEY TO SYMBOLS (Tex-fig. 1).

Tree Stratum.
E, *Eucalyptus piperita.*
Tall-shrub Stratum.
Ad, *Acacia discolor.*
Aj, *Acacia juniperina*
Bm, *Banksia marginata.*
Bs, *Banksia spinulosa.*
Cc, *Choretrum Candollei.*
Hd, *Hakea dactyloides.*
Ia, *Isopogon anemonifolius.*
Le, *Leptomeria acida.*
Lp, *Leptospermum stellatum*

Tall-shrub Stratum (contd.).
Ph, *Pomaderris ledifolia.*
Ps, *Persoonia salicina.*
Pu, *Pultenaea scabra.*
Tl, *Trachymene linearis.*
Ts, *Telopea speciosissima.*
Low-shrub Stratum.
As, *Acacia linifolia* var.
Bo, *Bossiaea scolopendria.*
Cf, *Caustis flexuosa.*
D, *Dianella* sp.
Ds, *Dampiera stricta.*
Gb, *Goodenia bellidifolia.*

Low-shrub Stratum (contd.).
Li, *Lissanthe sapida.*
Ls, *Lomatia silaifolia.*
Mg, *Mirbelia grandiflora.*
Pp, *Phyllota phylicoides.*
Pt, *Pteridium aquilinum.*
Xa, *Xanthorrhoea hastilis.*
Xl, *Xerotes longifolia.*
Xp, *Xanthosia pilosa.*

A line through a symbol indicates a young plant or seedling.

consequence of the latter, the fires frequently run up the Eucalyptus trees and burn off their foliage; but it is evident that the low water-content of the leaves is the chief factor accelerating the fires, since they travel mainly through the shrub-stratum, where the percentage of oil-containing types is not high. Moreover, the essential oils themselves, unless in leaves of low moisture-content, do not make burning possible; for fires have not been observed to have passed through the Rain-Forest, although *Doryphora* contains as much essential oil of an inflammable nature (approximately 1%) as many species of *Eucalyptus* (Penfold, 1921).

The recovery of *Eucalyptus* trees after fire has been referred to in Part I: if the foliage is burnt, it is renewed by the production of adventitious shoots from the stem (see Plate xxi, fig. 4); if the trunk is burned, new shoots arise from the base: indeed it is only occasionally, except at very high altitudes (*e.g.* on the Snowy Mountains), that a tree does not recuperate after fire. Similarly many of the shrubs possess subterranean rootstocks from which they send up new shoots after subaerial destruction by fire.

Thus after pyric denudation it is possible for regeneration to take place without the initiation of a sere: the previous community may reproduce itself without any alteration in structure, every plant reappearing in its previous place. At all events, since the area is a secondary one, and since it is improbable that the habitat factors are changed very much, if succession does take place, the sere is generally short and simple: there is as a rule nothing to prevent the migration and germination of seeds of the types previously existing in the habitat, which usually seize the opportunity of pyric denudation to establish their seedlings.

Such aberrations as appear in the early period of regeneration may be due to differences in readiness of renascence, in aptitude of establishment, or in aggressiveness, of different types. As an example of the first-mentioned factor may be instanced the rapid spread of *Pteridium* before the rootstocks of the shrubs have time to produce their shoots. In the association under discussion, however, on account of the unfavourableness of the habitat, this type is as a rule not sufficiently aggressive to prevent the developing shrubs from subsequently extinguishing it. Along with *Pteridium* in the early stages we have noticed *Dianella* spp., *Xerotes longifolia*, *Lomatia silaifolia*, and *Panax sambucifolius*, which appear to possess the ability of rapid renascence.

Many of the endemic types have also most unique adaptations for recolonisation after fire. In a poor siliceous soil like that produced by the Hawkesbury Sandstone there is keen competition between the different components of the vegetation for the small quantity of available nutriment and moisture. It is, therefore, to be expected that a species will always endeavour to seize any opportunity which may be afforded for gaining an ascendancy over the other members of the community; and it is obvious that, if seeds could be preserved during fire, such an opportunity would be gained, inasmuch as recolonisation would not have to await the comparatively slow process of migration from an unburnt adjacent area. Hence many types, notably most of the Myrtaceae and Proteaceae (especially *Hakea*), have developed an enormous amount of wood in the fruit, with the result that even if that structure is appreciably charred, the seed is uninjured; others, such as *Persoonia*, have succulent fruits, but hard seeds within; while hard seeds are found also in *Actinotus*, *Acacia*, etc. Thus protected from destruction during the fire, it is advantageous for these seeds to be able to germinate immediately afterwards: it is interesting to observe, therefore, that, while on account of their massive structure these fruits often do not open for a number of years, the heat of a fire causes immediate dehiscence; and many seeds appear also to profit by the fire inasmuch as it chars the testa and so allows penetration of moisture for germination.

These plants thus seem to have adapted themselves to benefit by fires, since they gain an opportunity of establishing seedlings before the regeneration of the previous components of the community; these seedlings are thereby given a start in competition, and can at all events take the place of any individuals which have not survived, and of such species as possess no means of renascence, thus gaining considerably in competition with the latter. In any case it is unlikely that much would be gained by scattering seeds through a more or less mature community growing in an unfavourable habitat, since all available space permitted for plants by the limiting soil-moisture factor would already be occupied. These plants, therefore, seem to find it best to withhold their seeds until a fire occurs; and fruits of *Hakea* sometimes remain on the tree for several years without dehiscing, the seeds still retaining their vitality.

The point to be gathered, then, is that the regeneration of Eucalyptus Forests following pyric denudation is not dependent on the comparatively slow process of migration, but is effected mainly by the renascence of the previous components, and also by aggregation, which is a most distinctive feature of this Australian endemic flora.

Not only is the greater part of Eucalyptus Forest secondary in nature, but many areas are not even mature. The ultimate composition is no doubt established, but some of the shrubs take a number of years to attain their maximum height, since their growth has the slowness characteristic of xerophytes.

The majority of the taller shrubs reach a height of from four to eight feet; but certain of them, notably *Banksia serrata*, *Hakea dactyloides* and *Persoonia salicina*, when given the opportunity, develop into small trees having a height of twelve to twenty feet.

THE EUCALYPTUS PIPERITA CONSOCIATION.

Distribution.

This is the most characteristic community of the sandstone plateau, and forms the greater bulk of the vegetation of the Mount Wilson region (see Plate xx, fig. 2). *Eucalyptus haemastoma* var. *micrantha* grows frequently on the more exposed westerly ridges. *E. Sieberiana* occurs generally throughout the consociation as a subordinate, becoming abundant at the apex of exposed bluffs on the western side, sometimes to the exclusion of *Eucalyptus piperita*, so that it forms a society; such societies are no doubt fragmentary representations of a *Eucalyptus Sieberiana* consociation which occurs on other parts of the Blue Mountains. *Eucalyptus eugenioides* was observed in one small area on a westerly headland.

Floristic Composition.

The following list includes the more typical components of the consociation as it occurs on the sandstone plateau in the immediate neighbourhood of Mount Wilson.

Tree Stratum.		*Eucalyptus haemastoma* Sm.	
Eucalyptus piperita Sm.	d	var. *micrantha* DC.	lo-lf
Eucalyptus Sieberiana F.v.M.	f-o*	*Eucalyptus eugenioides* Sieb.	lo

* In these lists, where two symbols are given, the first represents the more typical frequency.

Floristic Composition—continued.

Low-Tree Stratum.	
Banksia serrata L. .	o-r
Persoonia salicina Pers.	r-o
Hakea dactyloides Cav.	r
Callicoma serratifolia Andr.	la in gullies
Acacia elata Cunn.	lc in gullies
Tall-Shrub Stratum.	
Trachymene linearis Spreng.	c-o
Persoonia salicina Pers.	f-lc
Leptospermum flavescens Sm.	f-o
Leptospermum stellatum Cav.	f-o
Banksia spinulosa Sm.	f-o
Hakea dactyloides Cav.	f-o
Isopogon anemonifolius R.Br.	f-o
Telopea speciosissima R.Br.	o-f
Dillwynia ericifolia Sm.	o-f
Petrophila pulchella R.Br.	o-f
Acacia discolor Willd.	o-f
Acacia longifolia Willd.	o-la
Pultenaea scabra R.Br.	o-la
Pomaderris ledifolia Cunn.	o-lc
Persoonia mollis R.Br.	o
Persoonia acerosa Sieb.	o
Choretrum Candollei F.v.M.	o
Persoonia ferruginea Sm.	o
Xanthorrhoea hastilis R.Br.	o
Persoonia pinifolia R.Br.	o-r
Banksia marginata Cav.	o-r
Leptomeria acida R.Br.	r-o
Leucopogon lanceolatus R.Br.	r-o
Banksia collina R.Br.	lo
Hakea gibbosa Cav.	lo
Haemodorum planifolium R.Br.	lo
Darwinia taxifolia Cunn.	lo
Leptospermum stellatum Cav. var. *grandiflorum* Benth.	lo
Cassinia denticulata R.Br.	lo
Exocarpus stricta R.Br.	r
Leptospermum scoparium Forst.	r
Oxylobium trilobatum F.v.M.	r
Callistemon lanceolatus DC.	vr
Low-Shrub Stratum.	
Phyllota phylicoides Benth.	a-f
Ionidium filiforme F.v.M.	f
Dianella revoluta R.Br.	f-o
Lissanthe sapida R.Br.	f-o
Tetratheca ericifolia Sm.	o-a
Tetratheca thymifolia Sm.	o-a
Pteridium aquilinum Kuhn.	o-la
Acacia linifolia Willd. var.	o-la
Lomatia silaifolia R.Br.	o-c
Dampiera stricta R.Br.	o-c

Low-Shrub Stratum (contd.).	
Goodenia bellidifolia Sm.	o-f
Mirbelia grandiflora Ait.	o-f
Amperea spartioides Brongn.	o-f
Dracophyllum secundum R.Br.	lf-la
Calochilus campestris R.Br.	lf
Cryptostylis longifolia R.Br.	lf
Grevillea laurifolia Sieb.	o
Dampiera Brownii F.v.M.	o
Dianella longifolia R.Br.	o
Marianthus procumbens Benth.	o
Goodenia heterophylla Sm.	o
Stylidium graminifolium Swartz.	o
Bossiaea heterophylla Vent.	o
Bossiaea scolopendria Sm.	o
Monotoca scoparia R.Br.	o
Actinotus Helianthi Labill.	o
Boronia pinnata Sm.	o
Mitrasacme polymorpha R.Br.	o
Helichrysum rutidolepis DC. societies	o
Xerotes flexifolia R.Br.	o
Xerotes longifolia R.Br.	o
Patersonia sericea R.Br.	o-r
Stylidium lineare Swartz.	r-o
Persoonia chamaepitys Cunn.	r-o
Lycopodium densum Labill.	r-o
Symphyonema montanum R.Br.	lo
Hibbertia serpyllifolia R.Br.	lo
Xanthosia pilosa Rudge	lo
Daviesia ulicina Sm.	lo
Marsdenia suaveolens R.Br.	r
Lindsaya linearis Swartz.	r
Panax sambucifolius Sieb.	r
Comesperma ericinum DC.	r
Helichrysum lucidum Henck.	r
Orthoceras stricta R.Br.	r
Smilax glyciphylla Sm.	r
Billardiera scandens Sm.	r
Boronia microphylla Sieb.	r
Trachymene Billardieri F.v.M.	vr
Goodenia decurrens R.Br.	vr
Todea barbara Moore	vr under rocks
Gastrodia sesamoides R.Br.	vr
Creeper.	
Kennedya rubicunda Vent.	r
Parasites.	
Loranthus celastroides Sieb.	o-f
Loranthus pendulus Sieb.	o
Cassytha glabella R.Br.	o

Leptospermum lanigerum *Society.*

The characteristic shrub-stratum of the *Eucalyptus piperita* consociation having been described, it remains to record a smaller shrub society which occurs in this community. In a stagnant depression about one hundred yards in diameter on the south-eastern side of the sandstone plateau, Eucalyptus trees are quite absent and a dense closed society of *Leptospermum lanigerum* occurs, having the following composition:

Leptospermum lanigerum Sm.	d	
Pteridium aquilinum Kuhn.	c-a	on outskirts
Blechnum discolor Keys.	f	,,
Acacia longifolia Willd.	o	,,
Hydrocotyle asiatica L.	o	,,
Viola hederacea Labill.	o	,,
Clematis aristata R.Br.	o	,,
Panax sambucifolius Sieb.	r	,,

Leptospermum lanigerum is a characteristic of damp and stagnant areas on sandstone. It is interesting to observe that the additional types on the outskirts, with the exception of *Acacia longifolia*, are all components of the *Eucalyptus goniocalyx-E. Blaxlandi* association which occurs at the edge of the basalt; it appears then that these types are governed in their distribution by a comparatively high minimum soil-moisture requirement. *Acacia longifolia*, however, is no doubt precluded by the proximity of the basalt from occurring in the *Eucalyptus goniocalyx-E. Blaxlandi* association.

THE EUCALYPTUS HAEMASTOMA VAR. MICRANTHA CONSOCIATION.

This community is much more restricted in its distribution than the *Eucalyptus piperita* consociation, being confined to ridges and headlands exposed to the west; and, so far as Mount Wilson is concerned, it is limited to the apex of such headlands. In these exposed habitats the soil tends to be swept away by the wind and is consequently shallow and rocky, which is perhaps the main factor preventing occupation by *Eucalyptus piperita*.

Eucalyptus haemastoma var. *micrantha*, while a medium-sized tree in the *E. piperita* consociation, is here stunted and excessively gnarled, its smooth white bark being in distinct contrast to the dark-gray fibrous bark of *E. piperita*.

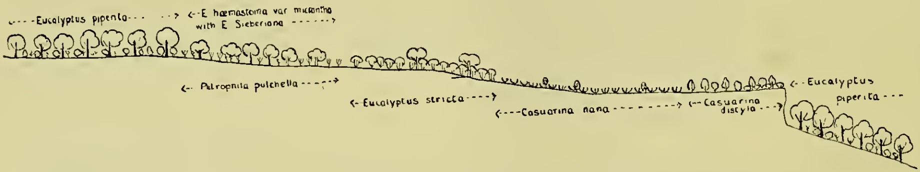
In habitats where exposure is more moderate, the shrub stratum is very similar in composition to that of the *Eucalyptus piperita* consociation, although of a more open structure. Under more extreme conditions, however, appear a number of highly xerophytic types which seem to be confined to westerly headlands. Their occupation of these habitats is no doubt due to the soil, which is too shallow and rocky for the typical components of the *Eucalyptus piperita* consociation.

As an example of the occurrence of these types a description is given of the vegetation of the apex of a very exposed westerly headland at Mount Wilson.

THE SHRUB SOCIETIES OF AN EXPOSED HEADLAND.

The sandstone plateau on the western side of Mount Wilson is composed of a series of projecting headlands. Those capped by basalt end in gentle slopes, and their plant-covering has been referred to in Part I and will be dealt with more fully in Part III; the purely sandstone headlands, on the contrary, usually terminate in an escarpment, at the base of which a talus slope extends down into the bed of the Wollangambe River.

Near the apex of one such headland the *Eucalyptus piperita* consociation gives place quite abruptly to that dominated by *E. haemastoma* var. *micrantha*. In the latter community there is first a zone in which *E. Sieberiana* is almost co-dominant and the trees are stunted and more open in structure; after this follows a zone in which the trees become rapidly thinner until they cease altogether at a distance of several hundred feet from the end of the headland; the shrubs, however, continue on to the top of the escarpment, forming a number of distinct and zoned communities (see Text-fig. 2, and Plate xxi, fig. 6).



Text-fig. 2.—Diagrammatic section (not to scale) of westerly headland at Mount Wilson, showing the distribution of the plant communities.

Beyond the limit of the trees, the shrub communities might be held to have the rank of associations, but since no sharp line can be drawn between those appearing as independent associations and those occurring as a subordinate stratum in the Forest, it is perhaps better to class all the communities as stratum-societies. It must be conceded, however, that the greatest alteration in the nature of the shrubs as they occur in the *Eucalyptus piperita* consociation takes place coincident with the dwindling away of the trees: within the Forest the change is rather that of the elimination of all but those types specially adapted to the more severe environment, the consequent greater abundance of the remainder, and the invasion of some of the new types from societies beyond the trees. The latter are absolutely distinctive and contain only a few types present in the shrub-stratum of the *Eucalyptus piperita* consociation. In these societies the majority of the characteristics are exclusive, being confined to exposed headlands of the highest altitudes of the Blue Mountains: such a restricted range points to a considerable degree of specialisation.

Petrophila pulchella *Society.*

The change in the composition of the shrub-layer as one passes from the *Eucalyptus piperita* consociation leads to the formation of a society dominated by *Petrophila pulchella.* A great many of the former shrub-components of the Forest are here absent, and also certain new types appear as invaders from the communities nearer the edge of the cliff. This society ceases coincidently with the tree-zone. It has a low and heath-like character, no doubt induced by the exposure of the environment (see Plate xxii, fig. 7). The Eucalyptus trees are stunted in this zone and are sparingly scattered, so much so that they are inclined to yield the dominance to the shrub-stratum.

Since this habitat is differentiated by its increased aridity, consequent upon the extreme degree of exposure to the west, and by the closeness of the rock to the surface of the soil, the composition of the *Petrophila* society suggests an interesting clue to the components of the Eucalyptus Forest which are most xerophilous in their adaptations. The majority of the shrubs are excluded; but *Petrophila pulchella* seems well adapted to the habitat, and so has come to dominate the society. Certain other components, such as *Hakea dactyloides*, *Isopogon anemonifolius*, *Banksia ericifolia*, *Trachymene linearis*, *Acacia linifolia* var., etc., likewise can tolerate the conditions, but evidently not so well as *Petrophila*, which has consequently gained a marked ascendancy in the competition among the species. Amongst the invaders from the adjacent societies at the apex of the headland may be mentioned *Casuarina nana*, *Hakea pugioniformis* and *Leptospermum lanigerum* var. *macrocarpum*.

Floristic Composition.

Shrub Stratum.		Low-Shrub Stratum.	
Petrophila pulchella R.Br.	d	*Baeckea brevifolia* DC.	f
Hakea pugioniformis Cav.	f-c	*Goodenia bellidifolia* Sm.	f
Hakea dactyloides Cav.	f	*Dampiera stricta* R.Br.	f
Banksia ericifolia L.	o-f	*Hibbertia serpyllifolia* R.Br.	f
Casuarina nana Sieb.	o	*Xerotes longifolia* R.Br.	vr
Trachymene linearis Spreng.	o	*Bossiaea* sp.	vr
Acacia linifolia Willd., var.	o	*Leptospermum lanigerum* Sm. var. *macrocarpum* Maiden and Betche	vr
Xanthorrhoea hastilis R.Br.	o		
Pomaderris ledifolia Cunn.	la		
Acacia discolor Willd.	r		

Eucalyptus stricta *Society.*

Immediately below the *Petrophila* society, as the headland begins to slope towards the escarpment, occurs a low, stunted, closed community of *Eucalyptus stricta*, with an occasional tree of *E. haemastoma* var. *micrantha* still present (see Plate xxii, fig. 9). *Eucalyptus stricta* is modified in its life-form by the early proliferation of the stem apex, so that several erect shoots are formed, resulting in a shrubby growth: such trees are locally known as "mallees" in Australia. This character is well marked in the individuals occurring in this community, and, together with the nanism resulting from the exposure of the habitat, causes the plants to attain a height of about only four or five feet. The significance of nanism in the habitat is shown by the fact that *Eucalyptus stricta* in some localities grows to a height of twenty feet.

Under the shelter of the canopy of *Eucalyptus stricta* occur a number of low shrubs, attaining about two feet in height.

Floristic Composition.

Tall-Shrub Stratum.		Low-Shrub Stratum (contd.).	
Eucalyptus stricta Sieb.	d	*Banksia spinulosa* Sm.	o
Hakea dactyloides Cav.	f	*Isopogon anemonifolius* R.Br.	o
Persoonia acerosa Sieb.	o	*Caustis flexuosa* R.Br.	o
Persoonia salicina Pers.	r	*Petrophila pulchella* R.Br.	o
Leptospermum stellatum Cav.	r	*Pomaderris ledifolia* Cunn.	o
		Hibbertia serpyllifolia R.Br.	o
Low-Shrub Stratum.		*Conospermum ericifolium* Sm.	o
Phyllota phylicoides Benth.	f	*Symphyonema montanum* R.Br.	r
Trachymene linearis Spreng.	f	*Xerotes longifolia* R.Br.	r

Casuarina nana *Society.*

Below the *Eucalyptus stricta* society occurs a dwarf-shrub heath composed chiefly of *Casuarina nana*, a stunted, heath-like bush about two feet high. As in a number of these societies, the dominant is not the tallest plant occurring in the community: here the monotony is relieved by an occasional plant of *Casuarina distyla*, a shrub about five feet in height. A few smaller shrubs also stand above the general level, especially *Petrophila*, which is frequent, and which, by its rich green, stands out conspicuously against the brown *Casuarina*. *Eucalyptus* is entirely absent from this wind-swept habitat.

Floristic Composition.

Tall-Shrub Stratum.
Casuarina distyla Vent. r-o

Shrub-Stratum.
Petrophila pulchella R.Br. f
Trachymene linearis Spreng. o
Leptospermum stellatum Cav. o
Hakea dactyloides Cav. o

Low-Shrub Stratum.
Casuarina nana Sieb. d
Isopogon anemonifolius R.Br. r

Low-Shrub Stratum (contd.).
Xerotes longifolia R.Br. r
Hakea pugioniformis Cav. r
Phyllanthus thymoides Sieb. r

Ground Stratum.
Goodenia bellidifolia Sm. a
Dampiera stricta R.Br. o
Sowerbaea juncea Sm. o
Hibbertia serpyllifolia R.Br. r-f
Patersonia sericea R.Br. r

Hakea pugioniformis *Society.*

This is another dwarf-shrub heath of a structure similar to that of the *Casuarina nana* society, and occupying erosion channels intersecting the habitat of that community (see Plate xxii, fig. 8). It is contrasted by its deep-green colour and the terete, pungent-pointed leaves at right angles to the stem, and the angular branching. A few taller types interrupt the closed community of the dominant in places.

Floristic Composition.

Tall-Shrub Stratum.
Eucalyptus stricta Sieb. r
Leptospermum stellatum Cav. r

Shrub Stratum.
Hakea pugioniformis Cav. d
Banksia ericifolia L. o
Petrophila pulchella R.Br. o

Shrub Stratum (contd.).
Hakea dactyloides Cav. o
Cassinia arcuata R.Br. r

Low-Shrub Stratum.
Casuarina nana Sieb. r

Ground Stratum.
Goodenia bellidifolia Sm. a
Hibbertia serpyllifolia R.Br. r

Casuarina distyla *Society.*

Finally, at the very apex of the headland, on a flat area of sandstone rock which has only a shallow layer of soil occurring in pockets and crevices, is found a more open society dominated by *Casuarina distyla.* The majority of the shrubs in this society are only about three feet high, as is the case with the dominants of the two societies just described; *Casuarina distyla*, however, attains a height of about five feet, and thus lends the community a distinctive appearance, a curious fact considering that this appears to be the most unfavourable habitat in the area under consideration.

Floristic Composition.

Tall-Shrub Stratum.
Casuarina distyla Vent. d
Eucalyptus stricta Sieb. o
Hakea gibbosa Cav. r

Shrub Stratum.
Petrophila pulchella R.Br. c
Banksia ericifolia L. f
Cassinia arcuata R.Br. f
Hakea dactyloides Cav. f
Brachyloma daphnoides Benth. o
Leptospermum stellatum Cav. o
Isopogon anemonifolius R.Br. o
Banksia spinulosa Sm. o
Banksia marginata Cav. o
Hakea pugioniformis Cav. o
Trachymene linearis Spreng. o

Shrub Stratum—*continued.*
Lasiopetalum ferrugineum Sm. var. *cordatum* Benth. r

Low-Shrub Stratum.
Xanthorrhoea hastilis R.Br. o
Leptospermum lanigerum Sm. var. *macrocarpum* Maiden and Betche o
Callitris Muelleri Benth. and Hook. seedlings o
Casuarina nana Sieb. o
Acacia suaveolens Willd. o
Dillwynia floribunda Sm. o
Trachymene Billardieri F.v.M. o
Persoonia acerosa Sieb. vr

Floristic Composition—continued.

Ground Stratum.

Hibbertia serpyllifolia R.Br.	f	*Chloanthes stoechadis* R.Br.	r
Dampiera stricta R.Br.	o	*Boronia pinnata* Sm.	r
Symphyonema montanum R.Br.	o	*Pimelia linifolia* Sm.	r
		Xerotes longifolia R.Br.	r

Baeckea brevifolia *Society.*

This is a community of very small types, averaging about a foot in height, and occupying areas on the rocky headland where moisture collects in the soil as a result of drainage from the higher parts of the ridge. It is difficult to realise why this area is not occupied by more of the types belonging to the other communities described, but indeed the sharp lines of demarcation between the societies on this headland have not yet been interpreted apart from the fact that zonation results from increasing exposure and shallowness of soil.

The habitat of this society appears to be a favourable one for orchids, three species being recorded in the following list, although others might probably be found in the proper season.

Floristic Composition.

Low-Shrub Stratum.		Ground Stratum.	
Baeckea brevifolia DC.	d	*Eriochilus autumnalis* R.Br.	a
Isopogon anemonifolius R.Br. seedlings	o	*Prasophyllum densum* Fitzg.	a
Cassinia arcuata R.Br.	o	*Chiloglottis diphylla* R.Br.	f
Eriostemon obovalis Cunn.	o	*Selaginella uliginosa* Spreng.	o
Dillwynia floribunda Sm.	r	*Mitrasacme polymorpha* R.Br.	o
Leptospermum lanigerum Sm. var. *macrocarpum* Maiden and Betche	r	*Drosera spathulata* Labill.	o
Brachyloma daphnoides Benth.	r	*Drosera binata* Labill.	o

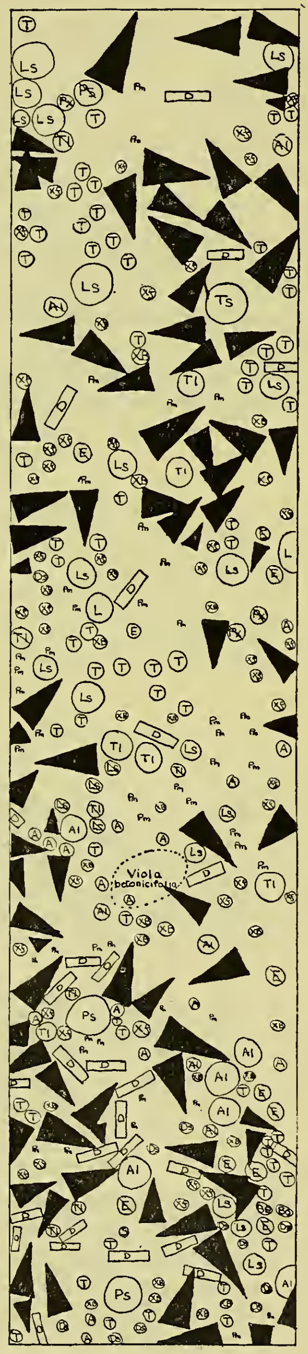
The Stratum-Societies of the Junction Flora.

Some additional observations have to be recorded upon certain of the stratum-societies of the Junction Flora. On the whole the components of these societies are less markedly sclerophyllous than those of the *Eucalyptus piperita-E. haemastoma* var. *micrantha* association of the dry sandstone, which are more extreme xerophytes; this shows how the *E. goniocalyx-E. Blaxlandi* association is an unusually mesophilous Eucalyptus Forest, a fact manifested also by the conspicuous pteridophyte element.

The societies are being dealt with separately here because certain of them are found in the *Eucalyptus piperita* consociation as well as in the *E. goniocalyx-E. Blaxlandi* association. The term *society* is being used in every case rather than *socies*, for, although it is improbable that all the communities are climaxes, the data have not yet been obtained for a clear knowledge of their stability and status.

Pteridium aquilinum *Society.*

We have already seen how the *Eucalyptus goniocalyx-E. Blaxlandi* association occurs as a rule at the periphery of the basalt except on southerly slopes, usually soon giving place, however, to the *Eucalyptus piperita* consociation as it passes on to the edge of the sandstone. The abutting margins of both these communities are occupied by the *Pteridium* stratum-society, as was made clear earlier. A close examination, however, has revealed a distinct difference in the composition of the



- ▲ *Pteridium aquilinum.*
- (A) *Amperea spartioides.*
- (Al) *Acacia longifolia.*
- (D) *Dianella* sp.
- (Ds) *Dampiera stricta.*
- (E) *Eucalyptus piperita.*
- (L) *Leucopogon lanceolatus.*
- (Ls) *Lomatia silaifolia.*
- Pm *Poranthera microphylla.*
- (Ps) *Persoonia salicina.*
- (Px) *Panax sambucifolius.*
- (S) *Solanum xanthocarpum.*
- (T) *Tetratheca thymifolia.*
- (Tl) *Trachymene linearis.*
- (Ts) *Telopea speciosissima.*
- (XB) *Xerotes Brownii.*
- (Xf) *Xerotes flexifolia.*

Text-fig. 3.—Belt-transect in the *Pteridium* society of the *Eucalyptus piperita* consociation near the basalt. Regeneration of typical sandstone shrubs is in evidence. (Scale 1 in. = 4 ft.)

subordinates of this society in the two consociations, as will be evident from the appended list and chart. This observation is of great significance, since it constitutes an important step towards the solution of the problem of the status of the *Pteridium* society which was discussed at some length in Part I.

The *Eucalyptus goniocalyx-E. Blaxlandi* association is confined to the damper soil; and it is natural, therefore, that the *Pteridium* society therein should include comparatively mesophilous types. It will be remembered that in this association, beneath the *Alsophila* society, occurs a *Blechnum* stratum-society, which merges into the *Pteridium* society near the outer boundary of the association. These two societies, excluding the *Pteridium* society in the *Eucalyptus piperita* consociation, bear certain resemblances in composition; and there is every reason to believe, not only that the two societies are similar in status, being differentiated owing to different degrees of environmental favourableness, but also that both are climactic. A critical examination of the Belt-Transect in Part I (Text-fig. 5, p. 491), which includes both the *Blechnum* and the *Pteridium* societies, shows that there is no suggestion in either of development to a community of higher status: there is not even a seedling of any type to which *Blechnum* or *Pteridium* could yield dominance. This chart brings out also the general similarity of structure and composition between these two societies. Reference has been made to the fact that the *Pteridium* society shows unmistakable signs of having been burnt out at no remote period; but fires have been observed to have passed through the *Blechnum* society over considerable areas of the *Eucalyptus-Alsophila* Forest; and just as the latter unquestionably regenerates without change in structure, so also no doubt has the *Pteridium* society regenerated, and will regenerate if burnt again.

Let us turn now to a study of the *Pteridium* society in the more typical sandstone habitat of the *Eucalyptus piperita* consociation. Here a remarkable change has taken place in the structure of the society, which is the culmination of a slow transition as we pass from the one consociation to the other: the more mesophilous subordinates, such as *Geranium pilosum*, *Tylophora barbata* and *Stellaria pungens*, have been replaced by xerophytes, notably *Lomatia silaifolia*, *Tetratheca* spp., *Trachymene linearis*, and even an occasional *Persoonia salicina* and *Acacia longifolia*. These features are clearly evinced in the accompanying belt-transect (Text-fig. 3), which forms a most instructive comparison with that to which reference was previously made. The society in the *Eucalyptus piperita* consociation is seen to include quite a number of species of shrubs characteristic of the consociation in its typical expression; and many of these shrubs are found to be in an early stage of renascence from old subterranean rootstocks or else to be in the seedling state.

The importance of this comparison cannot be overestimated, for it has now given the clue to the interpretation of the *Pteridium* society. *Eucalyptus piperita* has been able to establish itself in this habitat close to the basalt: it will be shown in Part III that this species can extend even on to the basalt if freed from competition. The typical shrubs associated with it, however, find greater difficulty in growing here, perhaps because their shallower roots are more exposed to the basalt soil; and, moreover, they are subjected to a severe struggle with *Pteridium*, which finds the habitat not unsuited to its requirements, and which is able to migrate from the *Eucalyptus goniocalyx-E. Blaxlandi* association by the slow but effective agency of its subterranean rhizome.

Now when the Forest is burnt out, *Pteridium* spreads rapidly, and forms the first stage of the subsere. If, as seems to be the case, this is not an ideal habitat for the sandstone shrubs, renascence and establishment of seedlings will no doubt, in any case, be delayed; and when these processes have to be effected in the face of heavy competition with *Pteridium*, it is easily seen that they will not be performed rapidly. So slow are they that the period between the last two fires in any spot has apparently never been long enough for the next stage of the sere definitely to establish itself, and *Pteridium* is at present the dominant throughout the whole of the Junction Flora. Yet renascence and migration are slowly but surely being accomplished, as is seen in the accompanying transect; although we are unable to state to what this may lead, or what may be the fate of the *Pteridium*. But we are almost safe in concluding that the *Pteridium* community here is neither a climax nor a sub-climax, and perhaps for the sake of distinction we might term it a *Pteridium* socies; and we have undoubtedly made a considerable advance in solving the problem of this somewhat enigmatic tract of vegetation.

Floristic Composition.

These lists represent typical examples of the two extremes of the *Pteridium* society, but it must be understood that there is an extensive ecotone region in which migration of sandstone types is very sparse.

	E. goniocalyx-E. Blaxlandi.	*E. piperita.*
Shrub Stratum.		
Acacia penninervis Sieb.	lo	lo
Acacia longifolia Willd.	—	f
Astrotricha floccosa DC.	—	r-o
Daviesia ulicina Sm.	o	o
Eucalyptus spp. saplings	lf	lf
Leucopogon lanceolatus R.Br.	—	o
Lomatia longifolia R.Br.	—	r
Panax sambucifolius Sieb.	—	o
Persoonia salicina Pers.	—	o
Telopea speciosissima R.Br.	—	o-f
Trachymene linearis Spreng.	—	f-c
Fern Stratum.		
Blechnum cartilagineum Swartz.	a	—
Blechnum discolor Keys.	la	—
Davallia dubia R.Br.	o	o-la
Dianella longifolia R.Br.	f	c-f
Dianella revoluta R.Br.	?	f
Gleichenia dichotoma Hook.	o-c	—
Lomatia silaifolia R.Br.	—	c-a
Phyllanthus thymoides Sieb.	—	lo
Polystichum aculeatum Schott.	lc	—
Pteridium aquilinum Kuhn.	d	d
Xerotes longifolia R.Br.	o	o
Ground Stratum.		
Acaena sanguisorba Vahl.	o	—
Amperea spartioides Brongn.	—	f
Brachycome sp.	o	—
Cardamine hirsuta L.	r-o	—
Chiloglottis formicifera Fitzg.	—	vr
Clematis aristata R.Br. seedlings	r-o	r
Dampiera stricta R.Br.	—	f
Dipodium punctatum R.Br.	—	r
Doodia aspera R.Br.	f	—
Galium umbrosum Sol.	o-la	—
Geranium pilosum Sol.	a	—
Hydrocotyle asiatica L.	o-c	—

Floristic Composition—continued.

	E. goniocalyx-E. Blaxlandi.	*E. piperita.*
Lobelia dentata Cav.	—	r
Lycopodium densum Labill.	—	vr
Mirbelia grandiflora Ait.	—	vr
Oxalis corniculata L.	o	—
Poranthera microphylla Brongn.	r	c
Solanum xanthocarpum Schrad.	—	r-o
Sonchus sp.	—	r
Stackhousia viminea Sm.	—	r
Stellaria pungens Brongn.	c	—
Stellaria flaccida Hook.	f	—
Tetratheca thymifolia Sm.	—	f-a
Tetratheca ericifolia Sm.	—	lf
Trifolium sp.	r	r
Tylophora barbata R.Br.	f	—
Viola betonicifolia Sm.	o-f	o
Wahlenbergia gracilis DC.	—	r
Xerotes flexifolia R.Br.	—	f
Unidentified grasses	f	f
Climbers.		
Hardenbergia monophylla Benth.	—	o
Kennedya rubicunda Vent.	—	f
Smilax australis R.Br.	o	—

Acacia penninervis *Society.*

Reference has already been made to the dense societies of this plant occurring in the Junction Flora. It grows as a tall shrub or sapling in closed societies, such as are characteristic of succession by aggregation following fire. Eventually the plant reaches the height of 30 feet, and in some places groups of such trees are to be seen.

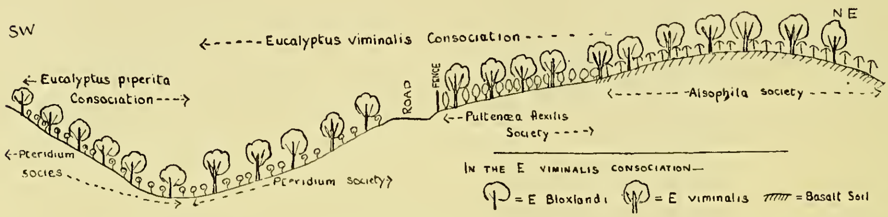
As an interpretation of the presence of these societies we may suppose that an occasional plant of *Acacia penninervis*. originally present in the association, might have preserved its seeds during fire; subsequent colonisation by aggregation from these, unhindered by competition with other species, would result in the local displacement of *Pteridium* and the formation of a dense and almost pure society of the new colonist. The plants, moreover, seem to multiply by the production of shoots from extensive lateral roots, and it may be that in some instances the societies have arisen in this way rather than by aggregation.

Pultenaea flexilis *Society.*

Although practically the whole of the Junction Flora bears the appearance of having been burnt within the last few years, in one place on a gentle south-west slope, a portion of the basalt junction was found inclosed in private land which has evidently not been burnt for a long period. The structure and composition of the vegetation here is of considerable interest, since it shows what the Junction Flora is capable of developing into when unburnt. The community occurs in the *Eucalyptus viminalis* consociation, with *Pultenaea flexilis* subdominant at the sandstone edge, becoming less abundant nearer the tree-ferns. This tall-shrub society extends from the foot of the *Alsophila* society a considerable distance down on to the sandstone; outside the fence flanking a road which has evidently acted as a fire-break, the characteristic *Pteridium* society occurs, as a result of regeneration following a recent fire (see Text-fig. 4).

It cannot be said definitely that the *Pteridium* society would develop to that dominated by *Pultenaea flexilis*; but the comparison of the vegetation on each side of the road shows that it may possibly do so in some parts, and the close resemblance in floristic composition adds support to the view.

Cattle have heavily trampled the ground between the shrubs, which has probably resulted in modifications in the fern stratum.



Text-fig. 4.—Diagrammatic section (not to scale) showing distribution of *Pultenaea flexilis* society.

Floristic Composition.

Tree Stratum.	
Eucalyptus viminalis Labill.	d
Eucalyptus Blaxlandi J.H.M. and R.H.C.	a
Acacia melanoxylon R.Br.	o
Eucalyptus goniocalyx F.v.M.	r
Tall-Shrub Stratum.	
Pultenaea flexilis Sm.	sd-c
Persoonia mollis R.Br.	f (a near tree-ferns)
Daviesia ulicina Sm.	f
Acacia longifolia Willd.	f-o
Citriobatus multiflorus Cunn.	o (a at tree-fern boundary)
Acacia elata Cunn. young plants	r
Leptomeria acida R.Br.	r
Acacia penninervis Sieb.	r at tree-fern boundary
Low-Shrub Stratum.	
Pteridium aquilinum Kuhn.	c-a
Helichrysum rutidolepis DC.	f
Xerotes longifolia R.Br.	f-o
Lomatia silaifolia R.Br.	o
Blechnum cartilagineum Swartz.	o near tree-ferns
Davallia dubia R.Br.	o
Polystichum aculeatum Schott.	o near tree-ferns
Blechnum discolor Keys.	o near tree-ferns
Leucopogon lanceolatus R.Br.	r-o
Ground Stratum.	
Similar to that given in Part I, p. 492	
Dawsonia sp.	r
Acianthus fornicatus R.Br.	r
Creepers.	
Geitonoplesium cymosum Cunn.	o
Billardiera longiflora Labill.	o
Clematis aristata R.Br.	o
Clematis glycinoides DC.	o
Eustrephus Brownii F.v.M.	r

Pultenaea flexilis *Society on Northern and Western Slopes.*

The *Eucalyptus goniocalyx-E. Blaxlandi* association on the edge of the basalt on the westerly slopes, is generally occupied by the *Pteridium* society which was described in Part I (p. 493); societies of *Pultenaea flexilis* occur in addition, however, as was also mentioned therein. On northerly slopes the typical *Pteridium* society supplants the *Alsophila* society in the region of sandstone intermixed with basalt talus, where also are found societies of *Acacia penninervis.* A little further down the slope the *Eucalyptus goniocalyx* consociation, which includes the above societies, suddenly gives place to the *E. piperita* consociation. This community possesses a modification in floristic composition characteristic of its occurrence on sandstone slopes below basalt caps, as will be described in Part III. Along the junction of these two consociations is frequently found a narrow belt of the *Pultenaea flexilis* society, similar in composition to the societies of the western slopes.

The composition of these societies differs somewhat from that of the society on the southwest slope, containing more xerophytic types on account of the greater exposure of the habitat.

The occurrence of these societies of *Pultenaea flexilis* is not easy of explanation. It may be that lack of further disturbance by fire will cause the society to develop in certain areas as a further stage in the sere initiated by the *Pteridium* society; from the conclusions to which we have come regarding the latter community, however, it seems unlikely that this could be at all general. The societies on the northern and western slopes may have arisen by aggregation in the manner suggested for *Acacia penninervis*; but the structure of the society on the southwestern slope shows that this, at any rate, did not originate in this way.

Floristic Composition.

Tall-Shrub Stratum.	
Pultenaea flexilis Sm.	d
Callicoma serratifolia Andr.	la
Telopea speciosissima R.Br.	f
Persoonia salicina Pers.	f
Banksia spinulosa Sm.	o
Choretrum Candollei F.v.M.	o
Persoonia mollis R.Br.	r
Low-Shrub Stratum.	
Lomatia silaifolia R.Br.	a-c
Daviesia ulicina Sm.	c
Low-Shrub Stratum (contd.).	
Pteridium aquilinum Kuhn.	c
Xerotes longifolia R.Br.	f
Trachymene linearis Spreng.	f
Acacia juniperina Willd.	o
Dianella sp.	o
Xerotes flexifolia R.Br.	o
Amperea spartioides Brongn.	o
Davallia dubia R.Br.	o
Climber.	
Eustrephus Brownii F.v.M.	r

SUMMARY.

1. The paper comprises an account of the Eucalyptus Forests of the plateau at Mount Wilson.

2. A general account of the main features of Eucalyptus Forest is given, and the classification of those occurring at Mount Wilson is placed upon a more permanent basis.

3. Two associations are described, viz., the *Eucalyptus goniocalyx-E. Blaxlandi* association, which includes what were previously called tentatively the *Eucalyptus-Alsophila* association and the *Eucalyptus-Pteridium* association (in part); and the *Eucalyptus piperita-E. haemastoma* var. *micrantha* association, which occupies the dry sandstone plateau. The dominants of both these associations occur always in consociations.

4. The nomenclature and the distribution of the consociations of the *Eucalyptus goniocalyx-E. Blaxlandi* association are discussed; and the structure and physiognomy of the *Eucalyptus piperita-E. haemastoma* var. *micrantha* association is described, special consideration being given to its relation to fires.

5. A description follows of a number of stratum-societies occurring on an exposed westerly headland in the *Eucalyptus haemastoma* var. *micrantha* consociation.

6. In conclusion, some further observations are recorded on the stratum-societies of the Junction Flora, with a special discussion of the status of the *Pteridium* society.

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EXPLANATION OF PLATES XX—XXII.

Plate xx.

1.—The *Eucalyptus goniocalyx* consociation, showing the dominant in the centre and a tall *Alsophila* on the left.

2.—A westerly slope of the sandstone plateau, clothed with the *Eucalyptus piperita* consociation.

Plate xxi.

3.—A portion of the *Eucalyptus piperita* consociation, showing profuse development of shrubs. *Pultenaea scabra* is in the left foreground.

4.—The *Pteridium* society in the *Eucalyptus piperita* consociation near the basalt junction. The trees are seen to be recovering from fire by the production of adventitious shoots on the stems.

5.—A view in the *Eucalyptus viminalis* consociation. The dominant can be distinguished by its white stem, the black trunks being those of *E. Blaxlandi.*

6.—A view on the exposed westerly headland described in the text. The low trees in the background are *Eucalyptus haemastoma* var. *micrantha,* the taller trees being *E. Sieberiana.* The *E. stricta* society is immediately in front of these trees, while the middle distance and foreground are occupied by the *Casuarina nana* society. In the immediate foreground is a plant of *Leptospermum lanigerum* var. *macrocarpum.*

Plate xxii.

7.—The *Petrophila pulchella* society in the *Eucalyptus haemastoma* var. *micrantha* consociation.

8.—Another view on the exposed westerly headland, showing the *Casuarina nana* society in the foreground, and the *Hakea pugioniformis* society in an erosion channel in the background.

9.—The *Eucalyptus stricta* society. A dead tree of *E. haemastoma* var. *micrantha* is seen in the middle distance.